

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this Examiner's Amendment was given in a telephone interview with Mr. Norman L. Morales on June 15th, 2010.

This application is in condition for allowance except for the presence of claims 1-4, 6-10, 12-16, 18, 19 and 21 directed to non-elected invention without traverse. Accordingly, claims 1-4, 6-10, 12-16, 18, 19 and 21 have been cancelled.

2. The application has been amended as follows:

In the claims:

Please cancel claims 1-4, 6-10, 12-16, 18, 19, 21 and 22.

Change claim 23 to --~~A~~ method for analyzing a copper electroplating solution used in copper electroplating for filling a copper metal in a via-hole or a trench installed in a semiconductor product, which comprises using an electrochemical cell composed of a working electrode (rotary electrode), a reference electrode and a copper electrode (counter electrode) for a copper electroplating solution, electrolyzing ~~a~~ solution with the working electrode (rotary electrode) as a cathode so as to make ~~a~~ cathode current density controlled in ~~a~~ range of 0.1-20 A/dm², determining ~~a~~ time-dependent potential change between

the cathode and the reference electrode for a predetermined period of time after the start of the electrolysis, and judging fillability with the copper electroplating solution from the time-dependent change curve profile, wherein the fillability is judged by approximating a time-dependent potential change curve for a predetermined period of time after the start of an electrolysis, according to a Boltzmann's function represented by the following numerical formula (1), to thereby obtain a potential change speed dx in an initial stage and a potential convergent point A₂:

$$y = \frac{A_1 - A_2}{1 + e^{\frac{x-x_0}{dx}}} + A_2. \quad (1)$$

Change claim 24 to --A method for analyzing a copper electroplating solution containing an additive, which comprises using an electrochemical cell composed of a working electrode (rotary electrode), a reference electrode and a copper electrode (counter electrode) for a copper electroplating solution, electrolyzing a solution with the working electrode (rotary electrode) as a cathode so as to make a cathode current density controlled in a range of 0.1-20 A/dm², and determining a time-dependent potential change for a predetermined period of time after the start of an electrolysis to thereby judge a uniformity of electrodeposition (film properties and film thickness uniformity) with the solution, wherein a fillability is judged by approximating a time-dependent potential change curve for a predetermined period of time after the start of the electrolysis, according to a Boltzmann's function represented by the following numerical formula (1), to thereby obtain a potential change speed dx in an initial stage and a potential convergent point A₂:

$$y = \frac{A_1 - A_2}{1 + e^{\frac{x-x_0}{dx}}} + A_2. \quad (1)$$

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Change claim 25 to -- ~~A~~ method for analyzing a copper electroplating solution used in copper electroplating for filling a copper metal in a via-hole or a trench installed in a semiconductor product, which comprises using an electrochemical cell composed of a working electrode (rotary electrode), a reference electrode and a copper electrode (counter electrode) for a copper electroplating solution, electrolyzing ~~a~~ solution with the working electrode (rotary electrode) as a cathode so as to make ~~a~~ cathode current density controlled in ~~a~~ range of 0.1-20 A/dm², controlling ~~a~~ rotation of the working electrode (rotary electrode) in two stages falling within a range of 0-7500 rpm, determining ~~a~~ time-dependent potential change between the cathode and the reference electrode at different rotations, and comparing time-dependent change curves with each other to thereby judge ~~a~~ fillability with the copper electroplating solution, wherein the fillability is judged by approximating ~~a~~ time-dependent potential change curve for a predetermined period of time after ~~a~~ start of ~~an~~ electrolysis, according to ~~a~~ Boltzmann's function represented by the following numerical formula (1), to thereby obtain ~~a~~ potential change speed dx in ~~an~~ initial stage and ~~a~~ potential convergent point A₂:

$$y = \frac{A_1 - A_2}{1 + e^{\frac{x-x_0}{dx}}} + A_2. \quad (1)$$

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Allowable Subject Matter

3. Claims 23-25 are allowed over prior art of record.

Reasons For Allowance

4. The following is an examiner's statement of reasons for allowance:

After further search and consideration of Applicants' response filed on February 24th, 2010 (see Applicants' argument in Page 11, line 8 to Page 12, line 16 of the February 24th, response), it is determined that the prior art of record neither anticipates nor renders obvious the claimed subject matter of the instant application as a whole either taken alone or in combination.

5. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Lee et al. (U.S. Patent 7,192,335) disclose method and apparatus for chemically, mechanically and/or electrolytically removing material from microelectronic substrates.
- Sato et al. (U.S. Patent 6,846,227) disclose electro-chemical machining apparatus to smoothing a metal film by efficiently reducing initial rough surface and removing excessive metal film with reduced damages to the metal films..

Correspondence

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khiem D. Nguyen whose telephone number is (571) 272-1865. The examiner can normally be reached on Monday-Friday (8:30 AM - 5:30 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew S. Smith can be reached on (571) 272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Khiem D. Nguyen/
Primary Examiner, Art Unit 2823
June 15th, 2010